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MCERTS odour monitoring of 2 No. biofilters serving the Phase 1 IVC and Phase 2 MBT at FCC Environment Wrexham

Permit Number

Phase 1 IVC - EAWML100079 / Phase 2 MBT - ERP/BB3436RA

Client

FCC Environment

Installation/Site

FCC Environment Wrexham

Date of Monitoring

23/11/2021

Type of Monitoring

Odour monitoring

Report Reference/Version

FCCE21B_MCERTS REPORT_03

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22/12/2021

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Executive Summary

Monitoring Objectives

Overall Aim of Monitoring Campaign

FCC Environmental commissioned Olfasense UK Ltd to undertake MCERTS odour monitoring of the inlet and outlet of 2 No. odour control units (OCUs) serving the In-Vessel Composting (IVC) and the Mechanical and Biological Treatment (MBT) process at their Wrexham Facility.

Target Parameters

The target parameters were as follows:

- Odour.

Special Requirements

No special requirements.

Executive Summary

Monitoring Results

Concentration

Emission Point	Parameter	Units	Result	*Uncertainty 95% (K=2)	
				Lower limit	Upper limit
PHASE 1 BIOFILTER INLET	Odour	ou _E /m ³	12,927	0.42	0.62
PHASE 1 BIOFILTER OUTLET	Odour	ou _E /m ³	939	0.42	0.62
PHASE 2 SCRUBBER INLET	Odour	ou _E /m ³	22,830	0.42	0.62
PHASE 2 BIOFILTER OUTLET	Odour	ou _E /m ³	3,136	0.42	0.62

*Uncertainties are percentages of the reported value presented as decimals.

Mass Emission

Emission Point	Parameter	Units	Result	*Uncertainty 95% (K=2)	
				Lower limit	Upper limit
PHASE 1 BIOFILTER INLET	Odour	ou _E /s	168,051	0.43	0.62
PHASE 1 BIOFILTER OUTLET	Odour	ou _E /s	21,597	0.42	0.62
PHASE 2 SCRUBBER INLET	Odour	ou _E /s	134,697	0.63	0.77
PHASE 2 BIOFILTER OUTLET	Odour	ou _E /s	14,426	0.63	0.77

*Uncertainties are percentages of the reported value presented as decimals.

Physical Parameters

Emission Point	Actual volumetric airflow [m ³ /s]	Volumetric Airflow [Nm ³ /s] 273K 101.3 kPa	Volumetric Airflow [Nm ³ /s] 293K 101.3 kPa	Temperature [°C]
PHASE 1 BIOFILTER INLET	12.6	12.1	13.0	16.1
PHASE 1 BIOFILTER OUTLET	22.0	21.4	23.0	11.7
PHASE 2 SCRUBBER INLET	5.9	5.5	5.9	25.1
PHASE 2 BIOFILTER OUTLET	4.5	4.2	4.6	22.8

Reference Conditions

Parameter	Parameter	Standard conditions
Odour	BS EN 13725:2003	101.3 kPa, 293K, wet basis

Emission Limit Value

Emission Point	Units	Emission Limit Value
PHASE 1 BIOFILTER INLET	ou _E /s	N/A
PHASE 1 BIOFILTER OUTLET	ou _E /s	N/A
PHASE 2 SCRUBBER INLET	ou _E /s	N/A
PHASE 2 BIOFILTER OUTLET	ou _E /s	N/A

Executive Summary

Monitoring & Analysis Date & Times

Monitoring Date & Times

Emission Point	Parameter	Date	Times of sampling		Duration [HH:MM]
			Start	Finish	
PHASE 1 BIOFILTER INLET	Odour	23/11/2021	14:17	14:36	00:19
PHASE 1 BIOFILTER OUTLET	Odour	23/11/2021	14:17	14:39	00:22
PHASE 2 SCRUBBER INLET	Odour	23/11/2021	12:03	12:30	00:27
PHASE 2 BIOFILTER OUTLET	Odour	23/11/2021	12:03	12:30	00:27

Analysis Date & Start Times

Emission Point	Parameter	Date	Start time of analysis
PHASE 1 BIOFILTER INLET	Odour	24/11/2021	10:18
PHASE 1 BIOFILTER OUTLET	Odour	24/11/2021	10:49
PHASE 2 SCRUBBER INLET	Odour	24/11/2021	11:39
PHASE 2 BIOFILTER OUTLET	Odour	24/11/2021	12:16

Monitoring & Analytical Methods

General Information

Monitoring				Analysis			
Parameter	Standard	MCERTS #	UKAS lab #	Technique	UKAS lab #	LLOD*	Units
Odour	BS EN 13725: 2003	2430	2430	Olfactometry	2430	30	ou _E /m ³

*Lower limit of detection

Analysis Laboratories

Laboratory	Parameter	Accreditation and number
Olfasense UK Ltd, Bristol	Odour	UKAS laboratory 2430

Executive Summary

Operating Information & Monitoring Deviations

Operational Details at Time of Sampling

PHASE 1 IVC OCU

Parameter	Value
Continuous/batch process	Continuous
Amount of batch sampled (if applicable)	N/A
Process status	Normal operating conditions confirmed by site operational staff.
Feedstock (if applicable)	IVC process airstream
Normal load/throughput of plant	approx. annual tonnage 18,000T
Abatement system used	Biofilters
Fuel used (if applicable)	N/A
Details from operator's CEMS (if applicable)	N/A

PHASE 2 MBT OCU

Parameter	Value
Continuous/batch process	Continuous
Amount of batch sampled (if applicable)	N/A
Process status	Normal operating conditions confirmed by site operational staff.
Feedstock (if applicable)	MBT process airstream
Normal load/throughput of plant	approx. annual tonnage 37,000 T
Abatement system used	Acid scrubber & biofilter
Fuel used (if applicable)	N/A
Details from operator's CEMS (if applicable)	N/A

Monitoring Deviations

PHASE 1 IVC OCU

Parameter	Sampling location	Deviation
Velocity (EN 16911)	PHASE 1 BIOFILTER INLET	Sampling could not be undertaken in a section of duct which was straight within 5 Dh upstream and 2 Dh downstream of sample ports.
		Only 1 sample line was available for flow measurement.
		Flow swirl angle of >15 degrees.
Miscellaneous		The Phase 1 IVC biofilter has two separate inlet airstreams, with only one being safely accessible. Sampling was undertaken from the 1 No. accessible inlet airstream only. Note the outlet monitoring location represents the combined airstream.
Velocity (EN 16911)	PHASE 1 BIOFILTER OUTLET	Sampling could not be undertaken in a section of duct which was straight within 5 Dh upstream and 2 Dh downstream of sample ports.
		Only 1 sample line was available for flow measurement.
		Flow swirl angle of >15 degrees.

PHASE 2 MBT OCU

Parameter	Sampling location	Deviation
Velocity (EN 16911)	PHASE 2 SCRUBBER INLET	Sampling could not be undertaken in a section of duct which was straight within 5 Dh upstream and 2 Dh downstream of sample ports.
		Gas velocity not between 5m/s and 50m/s.
		Pitot tube used for gas velocity <5m/s.
		Only 1 sample line was available for flow measurement.
		Sampling from second flow measurement traverse not possible due to excessive condensate within ductwork.
		Flow swirl angle of >15 degrees.
Velocity (EN 16911)	PHASE 2 BIOFILTER OUTLET	Sampling could not be undertaken in a section of duct which was straight within 5 Dh upstream and 2 Dh downstream of sample ports.
		Gas velocity not between 5m/s and 50m/s
		Pitot tube used for gas velocity <5m/s.

Appendix 1

Monitoring Personnel

Monitoring Personnel

Position	Name	MCERTS Accreditation	MCERTS Number	Technical Endorsements
Senior consultant	Oliver Carter	Level 2	MM13 1242	LTE3
Sampling team supervisor	Alex Claridge-Ingham	Level 1	MM21 1614	N/A

Methods and Technical Procedures Used

Parameter	Standard	Technical Procedure
Odour	BS EN 13725:2003	QD18
Volume Flow Rate	BS EN ISO 16911-1:2013	QD19

Sampling Equipment

Description	I.D
Toughbook	TB16
Sampling barrel (for "lung sampling")	BARR03 & BARR04
Temperature meter	TEMP57
Temperature probe	TEMP57C
Pitot tube	PT02 & PT09
Micromanometer	FOW09
Humidity probe	GM58
Barometer	BAR02

Instrumental Analysers

Description	I.D
TESTO350 flue gas analyser (oxygen)	GM46

Miscellaneous Items

Description	I.D
Transport temperature logger	TEMP51
Gas alert monitors	GM62 & GM63

Appendix 2

Photos

PHASE 1 BIOFILTER INLET



PHASE 1 BIOFILTER OUTLET



PHASE 2 SCRUBBER INLET



PHASE 2 BIOFILTER OUTLET



Appendix 3

Flow Criteria Measurements

Flow Criteria Measurements - Summary

Parameter	Units	Emission Point	
		PHASE 1 BIOFILTER INLET	PHASE 1 BIOFILTER OUTLET
Duct diameter/depth	m	1.45	1.35
Cross-sectional area	m ²	1.65	1.43
Average gas temperature	°C	16.1	11.7
Average gas pressure	Pa	54.0	219.7
Average static pressure	Pa	-198.8	88.3
Pitot tube coefficient	-	0.828	0.828
Gas velocity	m/s	7.7	15.4
Actual volume flow rate	m ³ /s	12.6	22.0
Standardised volume flow rate [273K, 101.3kPa]	Nm ³ /s	12.1	21.4
Standardised volume flow rate [293K, 101.3kPa]	Nm ³ /s	13.0	23.0
Relative humidity	%	94.4	96.9
Average ambient temp	°C	11.2	11.2
Average barometric pressure	hPa	1028.9	1028.9

Parameter	Units	Emission Point	
		PHASE 2 SCRUBBER INLET	PHASE 2 BIOFILTER OUTLET
Duct diameter/depth	m	1.25	1.10
Cross-sectional area	m ²	1.23	0.95
Average gas temperature	°C	25.1	22.8
Average gas pressure	Pa	14.4	14.0
Average static pressure	Pa	-272.9	3.4
Pitot tube coefficient	-	1.004	1.004
Gas velocity	m/s	4.9	4.8
Actual volume flow rate	m ³ /s	5.9	4.5
Standardised volume flow rate [273K, 101.3kPa]	Nm ³ /s	5.5	4.2
Standardised volume flow rate [293K, 101.3kPa]	Nm ³ /s	5.9	4.6
Relative humidity	%	99.9	99.9
Average ambient temp	°C	19.3	14.7
Average barometric pressure	hPa	1030.9	1029.5

Flow Criteria Measurements - Average Velocity [Pa]

Traverse Point	Emission Point					
	PHASE 1 BIOFILTER INLET			PHASE 1 BIOFILTER OUTLET		
	Distance [m]	Traverse 1	Traverse 2	Distance [m]	Traverse 1	Traverse 2
1	0.06	42.8	-	0.06	264.2	-
2	0.14	35.7	-	0.13	245.5	-
3	0.21	34.8	-	0.20	238.0	-
4	0.32	38.4	-	0.30	202.3	-
5	0.43	50.1	-	0.40	184.3	-
6	0.63	57.5	-	0.58	174.6	-
7	0.82	61.8	-	0.77	161.5	-
8	1.02	62.0	-	0.95	177.3	-
9	1.13	65.5	-	1.05	191.9	-
10	1.24	66.9	-	1.15	246.9	-
11	1.31	66.1	-	1.22	265.9	-
12	1.39	66.2	-	1.29	284.3	-

Traverse Point	Emission Point					
	PHASE 2 SCRUBBER INLET			PHASE 2 BIOFILTER OUTLET		
	Distance [m]	Traverse 1	Traverse 2	Distance [m]	Traverse 1	Traverse 2
1	0.06	21.5	-	0.05	17.8	20.1
2	0.12	21.4	-	0.16	19.0	19.1
3	0.18	20.1	-	0.33	12.9	13.5
4	0.28	19.2	-	0.77	10.7	9.8
5	0.37	16.6	-	0.94	11.1	12.5
6	0.54	10.8	-	1.05	8.7	12.4
7	0.71	11.7	-	-	-	-
8	0.88	10.3	-	-	-	-
9	0.97	10.2	-	-	-	-
10	1.07	10.0	-	-	-	-
11	1.13	10.2	-	-	-	-
12	1.20	10.5	-	-	-	-

Flow Criteria Measurements - Temperature [°C]

Traverse Point	Emission Point					
	PHASE 1 BIOFILTER INLET			PHASE 1 BIOFILTER OUTLET		
	Distance [m]	Traverse 1	Traverse 2	Distance [m]	Traverse 1	Traverse 2
1	0.06	16.1	-	0.06	11.7	-
2	0.14	16.1	-	0.13	11.7	-
3	0.21	16.1	-	0.20	11.7	-
4	0.32	16.1	-	0.30	11.7	-
5	0.43	16.1	-	0.40	11.7	-
6	0.63	16.1	-	0.58	11.7	-
7	0.82	16.1	-	0.77	11.7	-
8	1.02	16.1	-	0.95	11.7	-
9	1.13	16.1	-	1.05	11.7	-
10	1.24	16.1	-	1.15	11.7	-
11	1.31	16.1	-	1.22	11.7	-
12	1.39	16.1	-	1.29	11.7	-

Traverse Point	Emission Point					
	PHASE 2 SCRUBBER INLET			PHASE 2 BIOFILTER OUTLET		
	Distance [m]	Traverse 1	Traverse 2	Distance [m]	Traverse 1	Traverse 2
1	0.06	25.1	-	0.05	22.9	22.7
2	0.12	25.1	-	0.16	22.9	22.7
3	0.18	25.1	-	0.33	23.0	22.6
4	0.28	25.1	-	0.77	22.9	22.7
5	0.37	25.1	-	0.94	22.9	22.7
6	0.54	25.1	-	1.05	22.9	22.7
7	0.71	25.1	-	-	-	-
8	0.88	25.1	-	-	-	-
9	0.97	25.1	-	-	-	-
10	1.07	25.1	-	-	-	-
11	1.13	25.1	-	-	-	-
12	1.20	25.1	-	-	-	-

Appendix 4

Odour Results

Odour Results

Emission Point	Date of analysis	Odour Concentration [ou _E /m ³]				Odour Emission Rate [ou _E /s]			
		Geomean	Sample 1	Sample 2	Sample 3	Geomean	Sample 1	Sample 2	Sample 3
PHASE 1 BIOFILTER INLET	24/11/2021	12,927	15,395	13,178	10,648	168,051	200,135	171,314	138,424
PHASE 1 BIOFILTER OUTLET	24/11/2021	939	1,042	1,026	774	21,597	23,966	23,598	17,802
PHASE 2 SCRUBBER INLET	24/11/2021	22,830	27,711	18,931	22,683	134,697	163,495	111,693	133,830
PHASE 2 BIOFILTER OUTLET	24/11/2021	3,136	3,689	2,485	3,364	14,426	16,969	11,431	15,474

Details of Analysis

Parameter	Laboratory	UKAS lab #	Analysis standard	Date of Analysis	Reference Odourant
Odour	Olfasense UK Ltd, Bristol	2430	BS EN 13725 : 2003	24/11/2021	Butanol

Analysis Date and Start Times

Emission Point	Parameter	Date	Start time of analysis
PHASE 1 BIOFILTER INLET	Odour	24/11/2021	10:18
PHASE 1 BIOFILTER OUTLET	Odour	24/11/2021	10:49
PHASE 2 SCRUBBER INLET	Odour	24/11/2021	11:39
PHASE 2 BIOFILTER OUTLET	Odour	24/11/2021	12:16

Appendix 5

Uncertainty & Combined Uncertainty - Odour

The uncertainty values quoted below have been calculated based upon a confidence interval of 95%.

Uncertainty Sources

Quantifiable Sources of Uncertainty	Non-quantifiable Sources of Uncertainty
Uncertainty of measurement of the volume flow.	Uncertainty associated with the representation of the sample in a temporal sense.
Uncertainty of the odour analysis according to BSEN13725.	Uncertainty associated with the conservation of the sample whilst the sample is drawn through the line.
Uncertainty of ancillary measurements.	Uncertainty associated with the conservation of the sample during transportation and storage.

Airflow Velocity >5m/s

Measurement	Device	*Uncertainty	Source
Gas velocity measurement	Micromanometer	0.06	Manufacturers specification
	Pitot tube	0.05	Calibration uncertainty
Gas density calculation	Testo 350 combustion analyser	0.02	Manufacturer's specification
	Thermocouple	0.01	In-house measurement
	Barometer	0.01	In-house measurement
	Micromanometer	0.06	Manufacturer's specification
Cross-sectional area A (determined from measurement of diameter)	Tape measure	0.01	In-house measurement
	Thermocouple	0.01	In-house measurement
Correction to reference conditions	Barometer	0.01	In-house measurement
	Micromanometer	0.06	Manufacturer's specification
	Thermocouple	0.01	In-house measurement
Odour (replicates n=3) lower limit / upper limit	Olfactometer	0.21 / 0.31	Analytical uncertainty

*Uncertainties are percentages of the reported value presented as decimals.

Lung Method >5m/s

Source of uncertainty	*Relative standard uncertainty	
	Upper limit	Lower limit
Combined relative standard uncertainty of result	0.31	0.22
**Expanded combined relative uncertainty of result 95% (k = 2)	0.62	0.43

*Uncertainties are percentages of the reported value presented as decimals.

**These uncertainties have been calculated based upon a total number of 24 measurement over the velocity traverse.

Lung Method <5m/s

Source of uncertainty	*Relative standard uncertainty	
	Upper limit	Lower limit
Combined relative standard uncertainty of result	0.31	0.22
**Expanded combined relative uncertainty of result 95% (k = 2)	0.63	0.44

*Uncertainties are percentages of the reported value presented as decimals.

**These uncertainties have been calculated based upon a total number of 24 measurement over the velocity traverse.